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Samoto et al.

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(54) **IMAGE RECORDING APPARATUS**

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B41J 29/02	(2006.01)
B41J 17/26	(2006.01)
B41J 11/00	(2006.01)
B41J 25/308	(2006.01)

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(58) **Field of Classification Search**

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See application file for complete search history.

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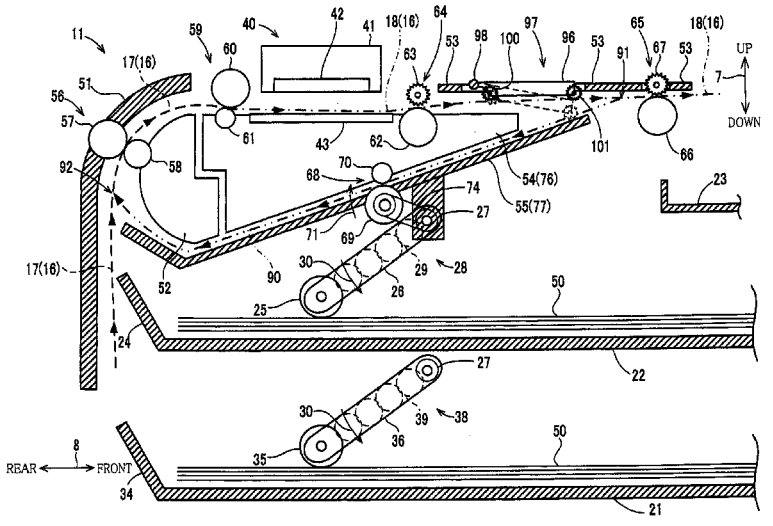
(57) **ABSTRACT**

An image recording apparatus including: a first conveying path for guiding a recording medium in a conveying direction; a recording portion configured to record an image on the recording medium guided by the first conveying path; a tray provided below the recording portion so as to accommodate the recording medium; a supplying roller configured to supply the recording medium accommodated by the tray to the first conveying path; a first arm provided above the tray, wherein the supplying roller is provided on a distal end of the first arm; a first frame configured to support the recording portion; and a second frame provided separately from the first frame and configured to support the first arm.

15 Claims, 9 Drawing Sheets



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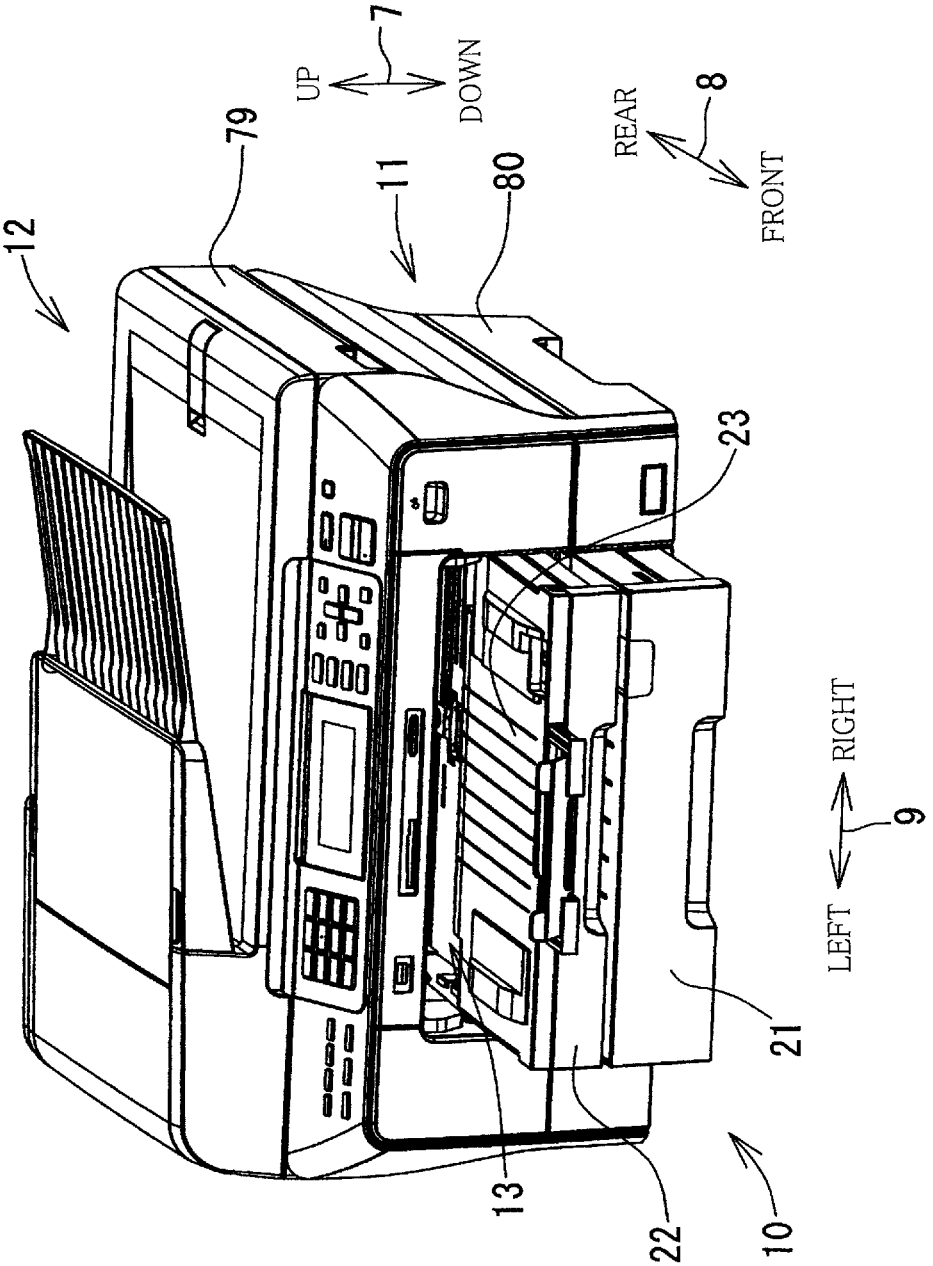
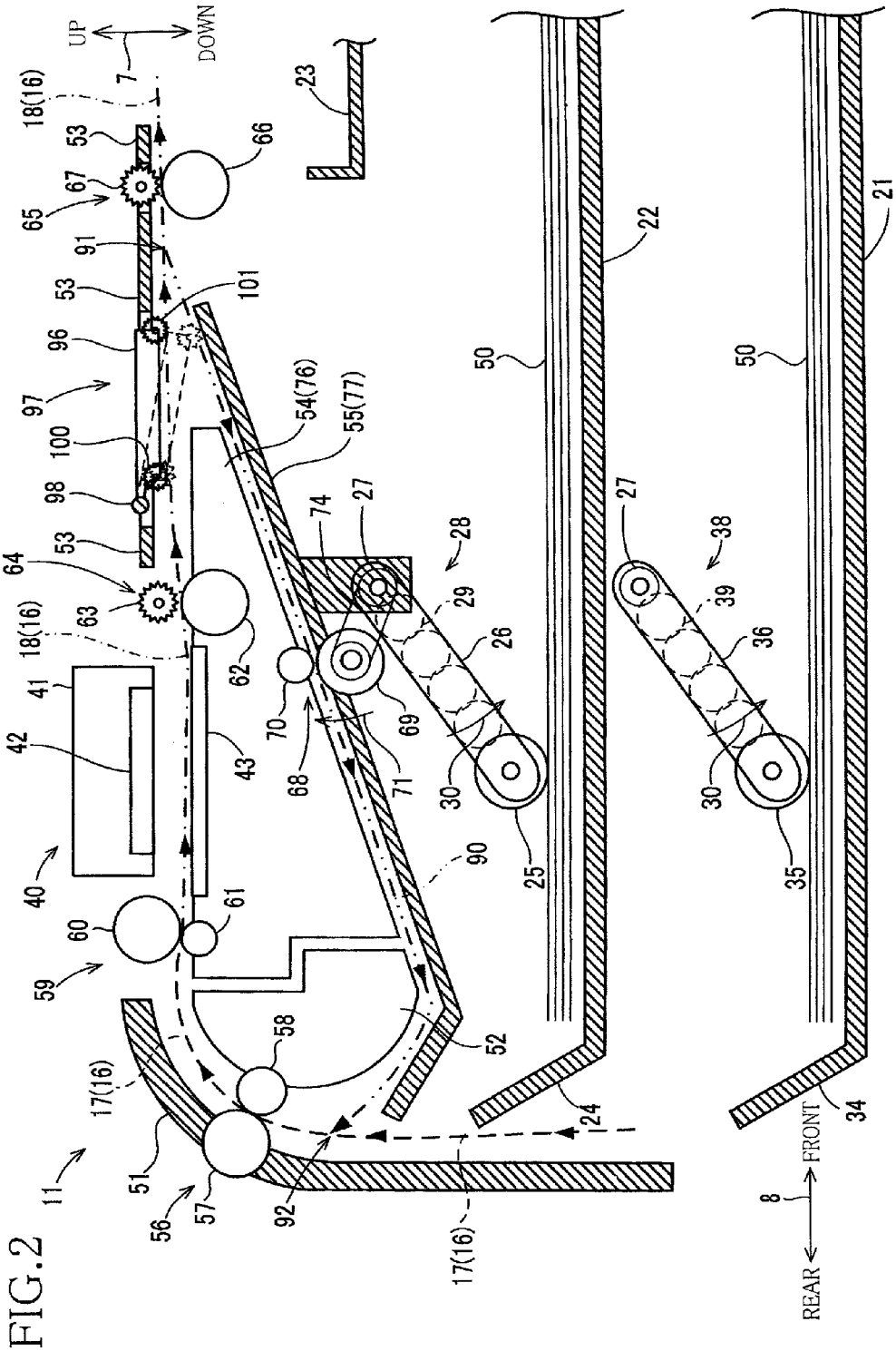


FIG. 1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18(16)
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54(76)
55(77)
74
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30
25
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21
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36
35
34
41
42
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17(16)
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92
11
24
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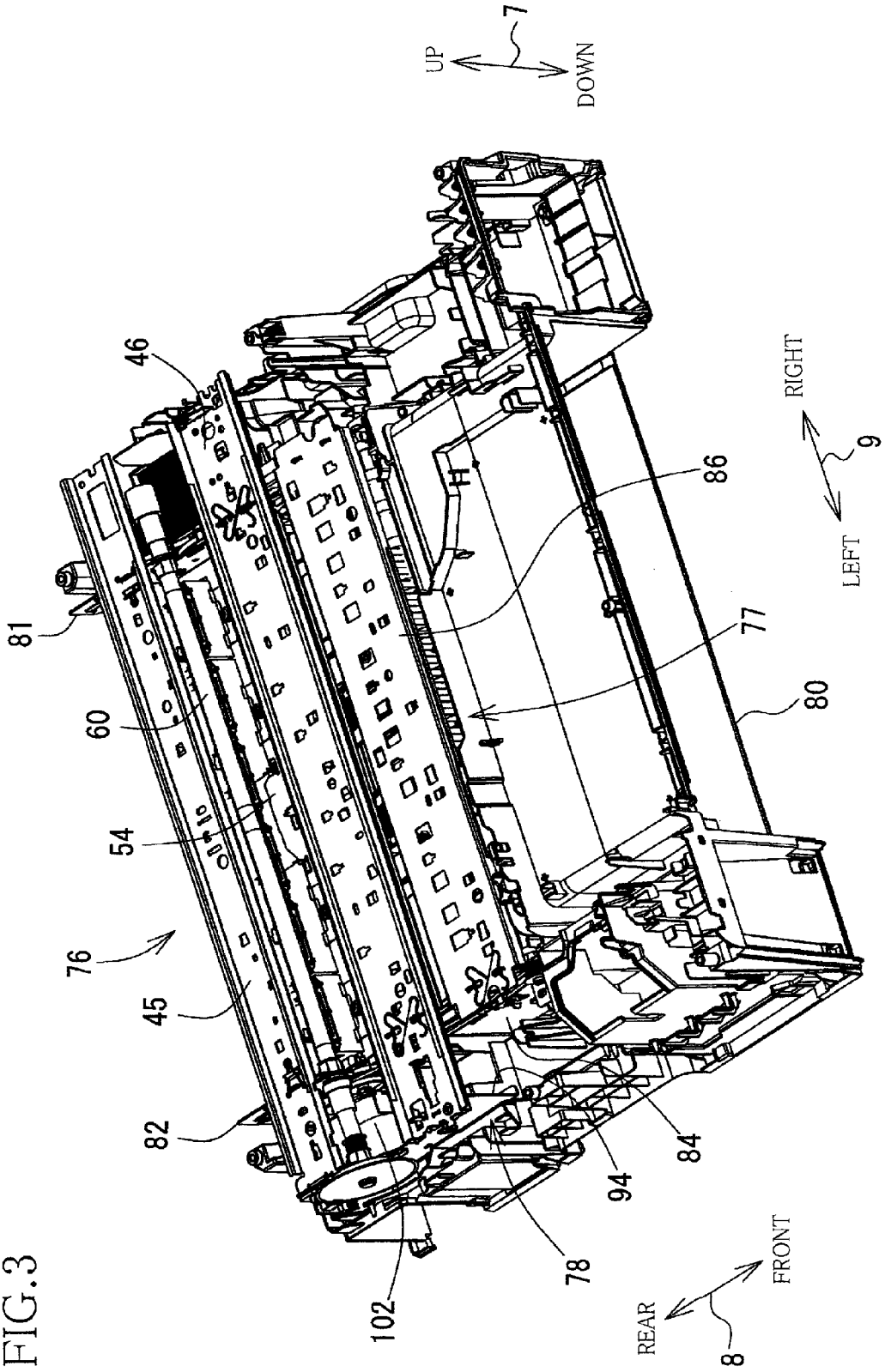
REAR
8

FIG.2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LEFT
9
FRONT
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76
45
82
102
78
94
84
86
77
80
H

FIG.3

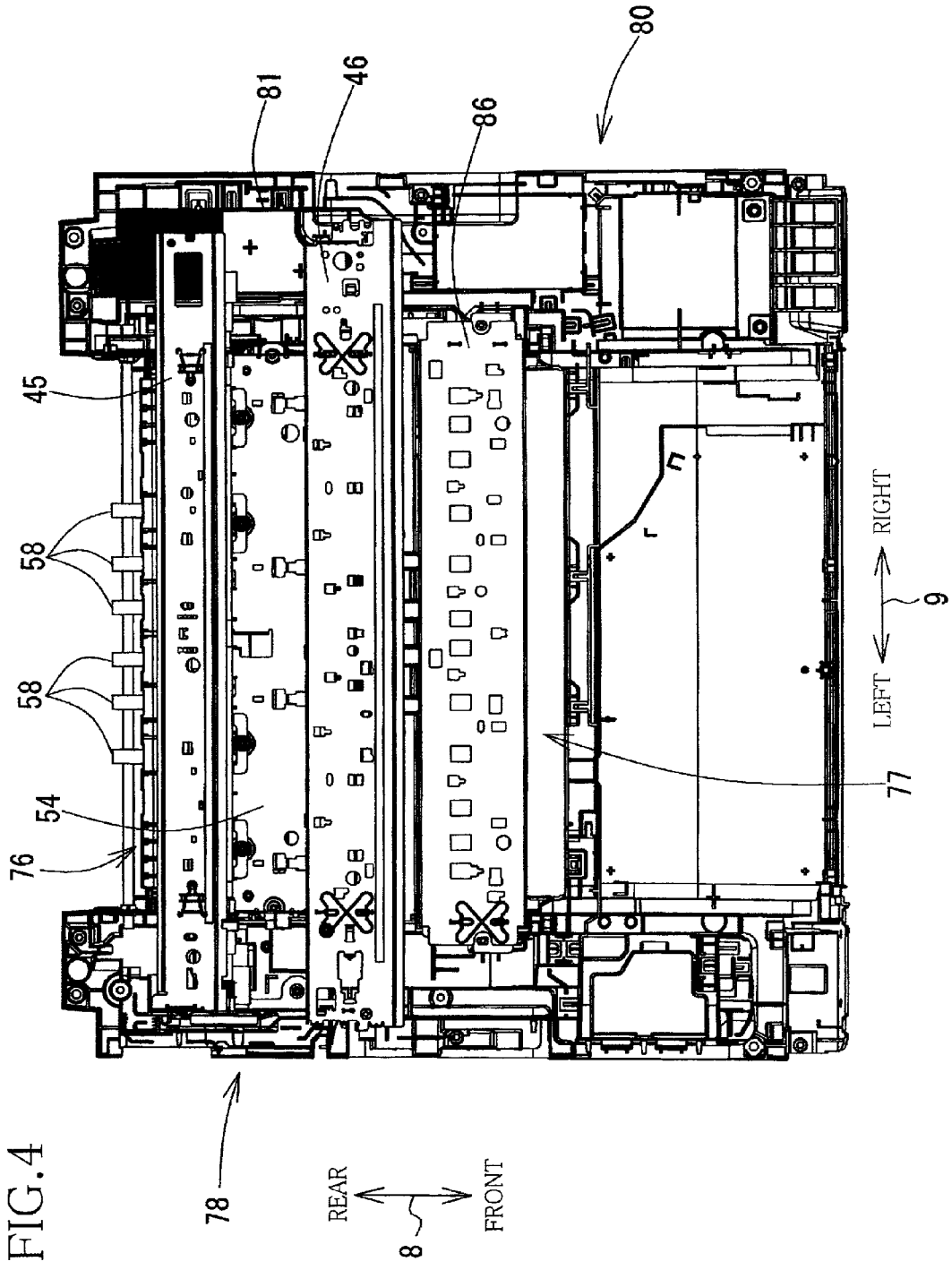
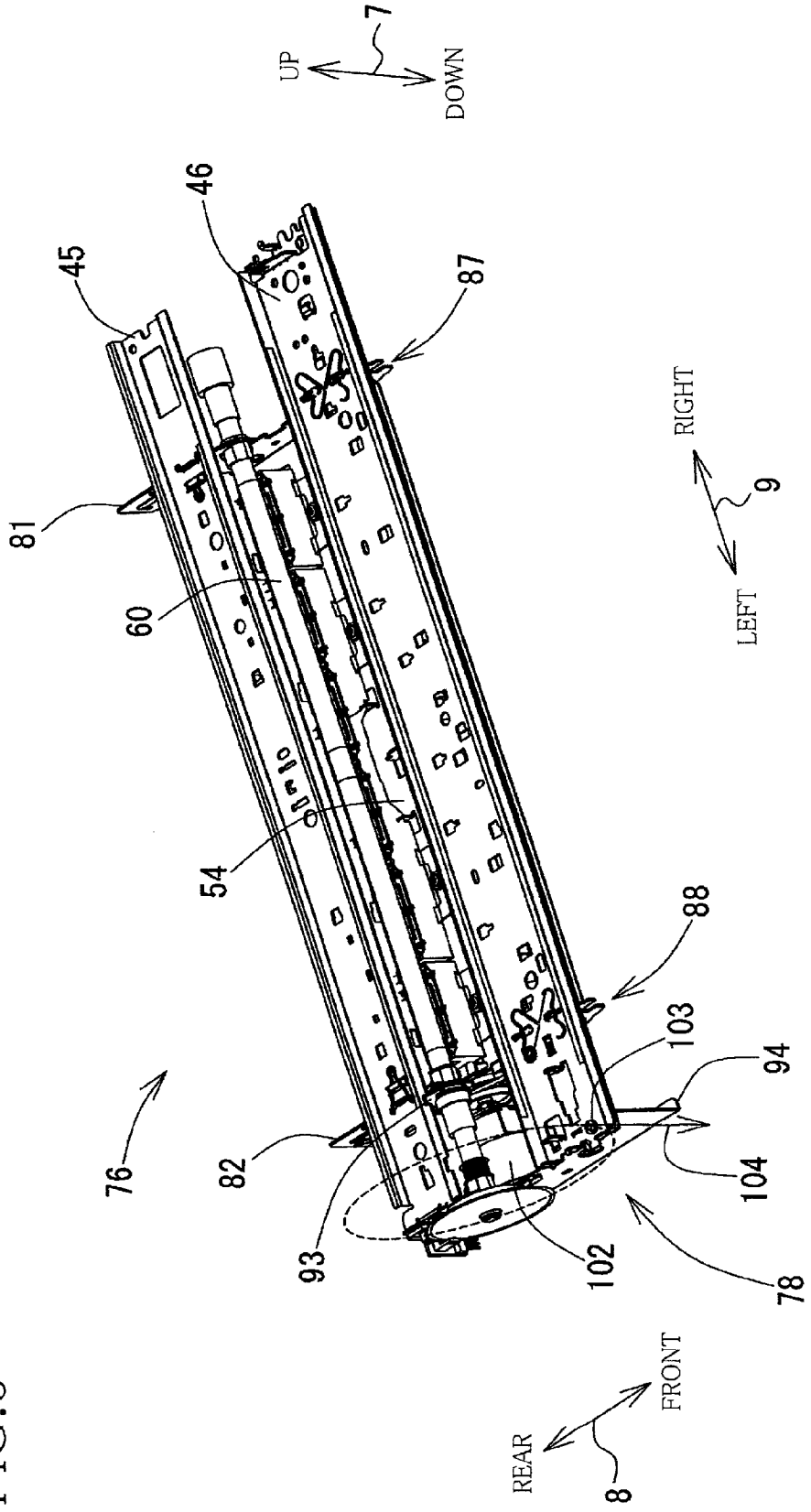


FIG. 4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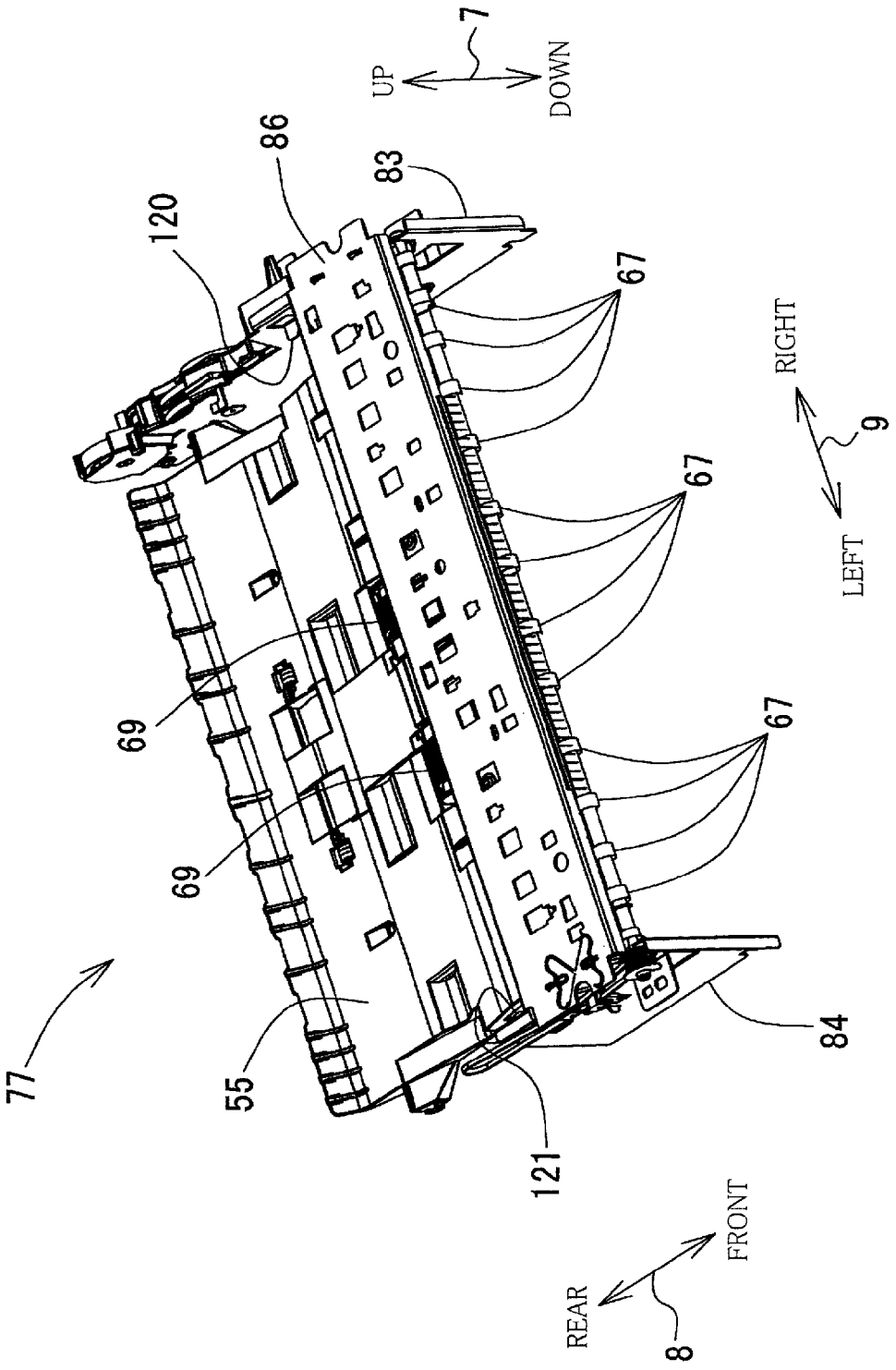
76
82
93
102
78

FIG.5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84
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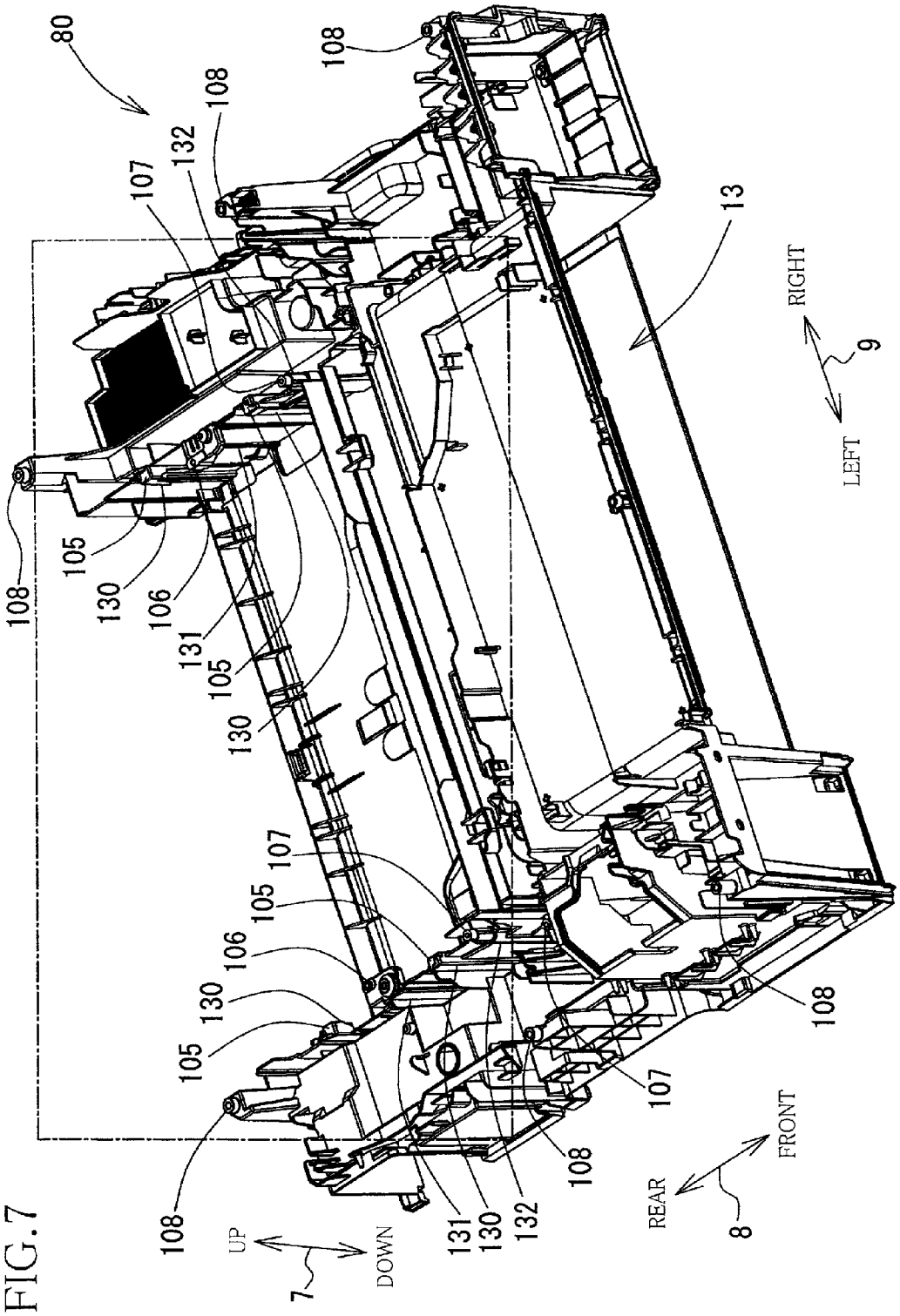
86
83

FIG.6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108
108
107
132
13
RIGHT
9
LEFT
105
130
106
131
105
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108
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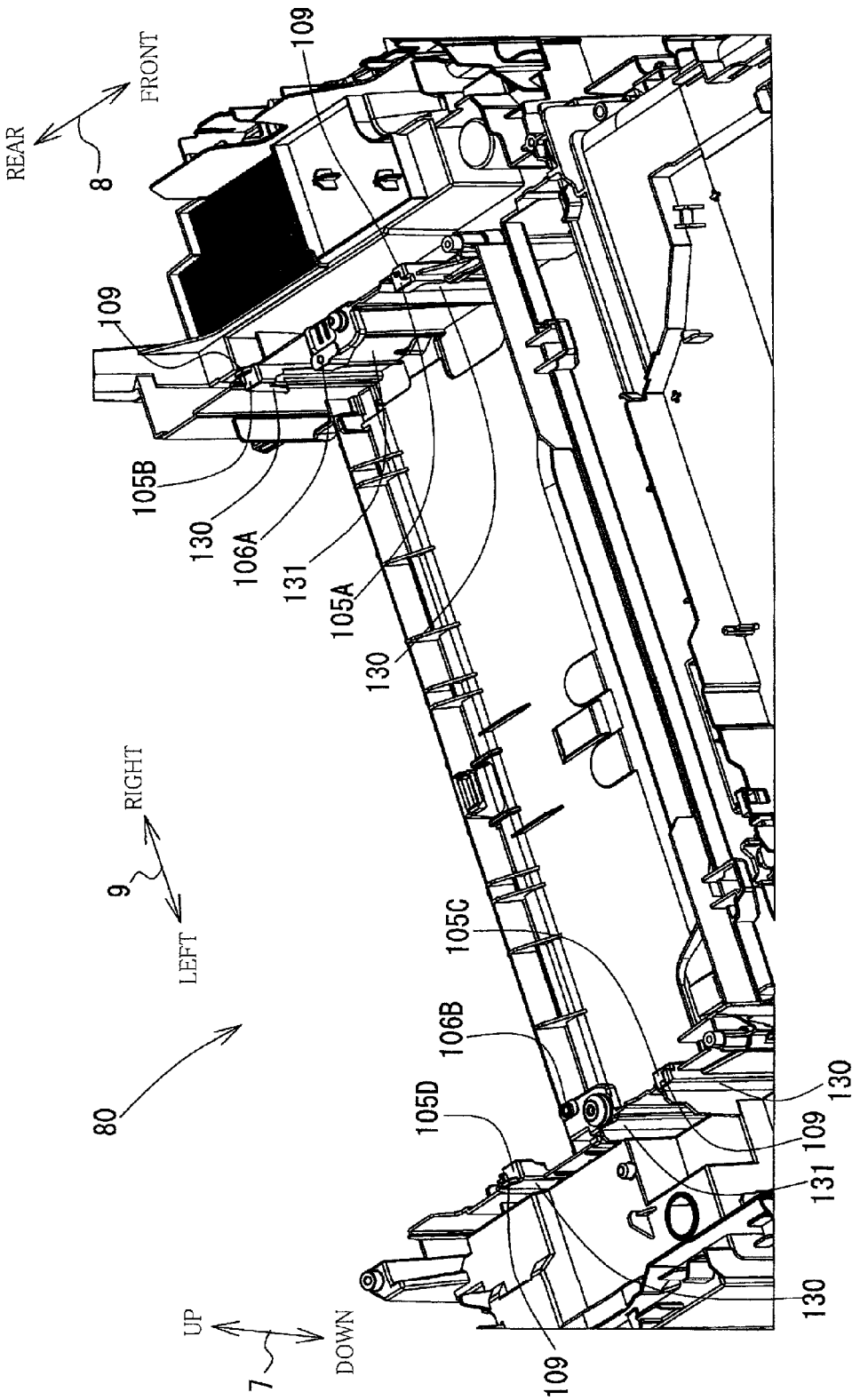
105
108
107
108
108
131
130
132
UP
7
DOWN
REAR
8
FRONT

FIG. 7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109
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105B
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106A
131
105A
130
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9
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106B
105D
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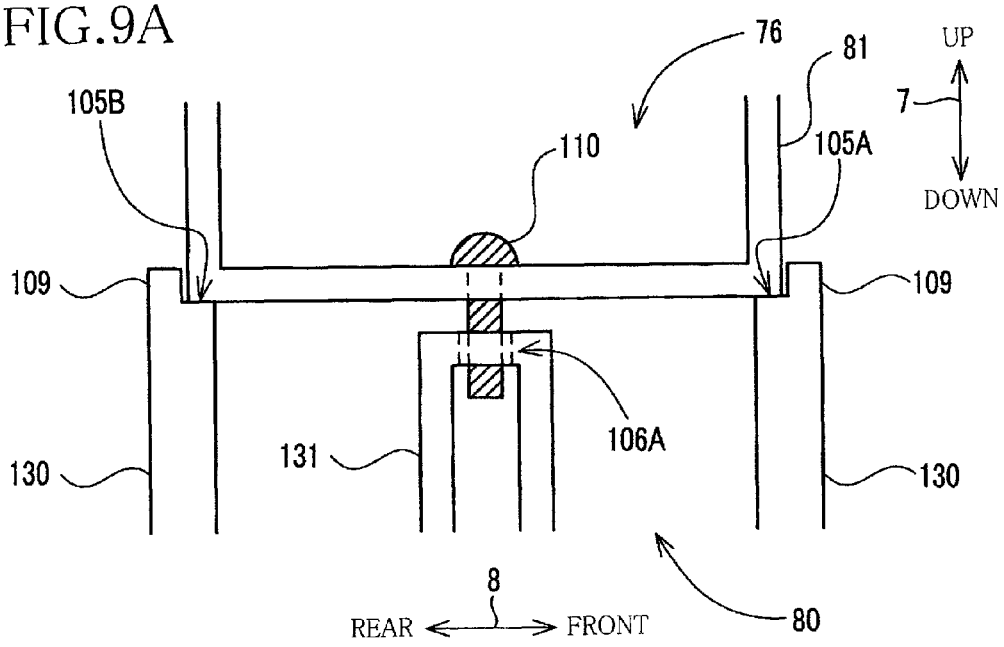
130
109
131
109
130
UP
7
DOWN
109

FIG.8

FIG.9A


76
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131
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FIG.9B

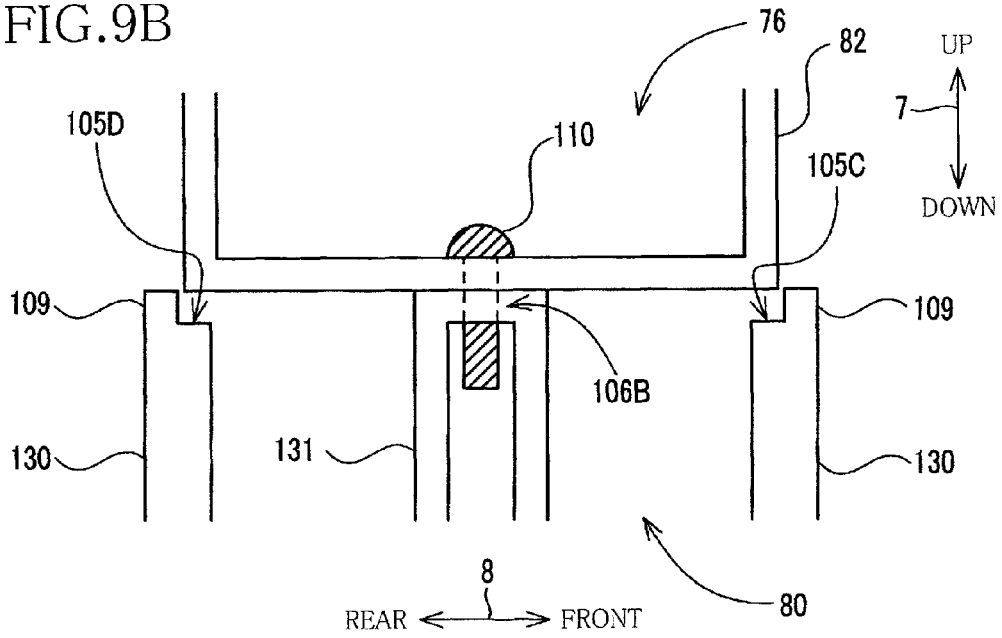
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IMAGE RECORDING APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

The present application claims priority from Japanese Patent Application No. 2010-137940, which was filed on Jun. 17, 2010, the disclosure of which is herein incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an image recording apparatus configured to convey a recording medium through a convey path and record an image on the recording medium.

2. Description of the Related Art

There is conventionally known an image recording apparatus including a sheet-supply portion configured to pick up a recording sheet accommodated in a tray and supply the recording sheet to a convey path. For example, the sheet-supply portion includes a sheet-supply roller, an arm, and a shaft. The sheet-supply roller is rotatably provided on a distal end portion of the arm. The shaft is provided on a basal end portion of the arm, and the arm is pivotable about the shaft. The arm is urged by its own weight or an elastic force of, e.g., a spring so as to be pivoted toward a tray. Where the sheet-supply roller is rotated in a state in which the sheet-supply roller is held in pressing contact with an uppermost one of the recording sheets on the tray, the recording sheet is supplied into the convey path by a frictional force between a roller face of the sheet-supply roller and the recording sheet.

Here, the shaft provided on the basal portion of the arm is normally mounted on a frame of the image recording apparatus. For example, there is a multi-function device (MFD) configured such that a sheet-supply roller is rotatably supported on a distal end of an arm, the arm is provided pivotably about a shaft, and the shaft is supported by an upper unit as a frame of the MFD.

SUMMARY OF THE INVENTION

In addition to the above-described shaft, the frame supports (a) a recording portion provided in the image recording apparatus, (b) a platen for supporting the recording sheet conveyed through a position just under the recording portion, and so on. Here, where the recording portion is of an ink-jet type, the recording portion is constituted by recording heads and a carriage holding the heads, for example. Where the recording portion is of an electronic-photography type, the recording portion is constituted by a drum unit and so on, for example.

However, where the recording portion, the platen, and so on, and the sheet-supply arm are supported by the same frame, the following problem may arise. Where a sheet-supply operation for supplying the recording sheet has been performed by the sheet-supply portion while the recording portion records the image on the recording sheet supported by the platen, a load of the sheet-supply arm is imposed on the frame in an upward and downward direction. This may cause a curl or a distortion of the frame, which may cause a curl or a distortion of the recording portion and the platen supported by the frame. Where these curls and/or distortions have been caused, a gap or a distance between the recording portion and the recording sheet supported by the platen is changed, leading to a deterioration of a quality of the image recorded on the recording sheet.

This invention has been developed in view of the above-described situations, and it is an object of the present invention to provide a structure configured to reduce an effect of a medium-supply operation on image recording, thereby reducing a deterioration of a quality of an image recorded on a recording medium.

The object indicated above may be achieved according to the present invention which provides an image recording apparatus comprising: a first conveying path for guiding a recording medium in a conveying direction; a recording portion configured to record an image on the recording medium guided by the first conveying path; a tray provided below the recording portion so as to accommodate the recording medium; a supplying roller configured to supply the recording medium accommodated by the tray to the first conveying path; a first arm provided above the tray, wherein the supplying roller is provided on a distal end of the first arm; a first frame configured to support the recording portion; and a second frame provided separately from the first frame and configured to support the first arm.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects, features, advantages, and technical and industrial significance of the present invention will be better understood by reading the following detailed description of an embodiment of the invention, when considered in connection with the accompanying drawings, in which:

FIG. **1** is a perspective view of a multi-function device (MFD) **10**;

FIG. **2** is an elevational view in vertical cross section schematically showing an internal structure of a printing section **11**;

FIG. **3** is a perspective view of frames **76-78** and a casing **80**;

FIG. **4** is a plan view of the frames **76-78** and the casing **80**;

FIG. **5** is a perspective view of the first frame **76** and the third frame **78**;

FIG. **6** is a perspective view of the second frame **77**;

FIG. **7** is a perspective view of the casing **80**;

FIG. **8** is an enlarged view partly showing components enclosed by a one-dot chain line in FIG. **7**; and

FIG. **9**A is an elevational view in vertical cross section schematically showing right support members **130**, **131**, and FIG. **9**B is an elevational view in vertical cross section schematically showing left support members **130**, **131**.

DETAILED DESCRIPTION OF THE EMBODIMENT

Hereinafter, there will be described an embodiment of the present invention by reference to the drawings. It is to be understood that the following embodiment is described only by way of example, and the invention may be otherwise embodied with various modifications without departing from the scope and spirit of the invention. In this embodiment, an upward and downward direction **7** is defined as a top and bottom direction of a multi-function device (MFD) **10** set in a usable state (shown in FIG. **1**). A frontward and rearward direction **8** is defined in a state in which a side of the MFD **10** on which an opening **13** is formed is a front side. A rightward and leftward direction **9** is defined in a state in which the MFD **10** is viewed from the front side. As directions of sheet-supply trays **21**, **22**, the upward and downward direction **7**, the frontward and rearward direction **8**, and the rightward and leftward direction **9** are defined in a state in which the trays **21**, **22** are mounted on the MFD **10** (shown in FIG. **1**).

<General Construction of Multi-Function Device **10**>

The MFD **10** is an example of an image recording apparatus to which the present invention is applied. As shown in FIG. **1**, the MFD **10** has a generally rectangular parallelepiped shape. A scanning section **12** is provided in an upper portion of the MFD **10**. A printing section **11** of an ink-jet recording type is provided in a lower portion of the MFD **10**. The MFD **10** has various functions such as a facsimile function and a printing function. It is noted that functions other than the printing function are optional and accordingly may be omitted.

The printing section **11** includes a casing **80** having the opening **13** on its front side. The sheet-supply trays **21**, **22** can be inserted or removed through the opening **13** in the frontward and rearward direction **8**. A plurality of recording media in the form of recording sheets **50** of various sizes can be stacked on the sheet-supply trays **21**, **22**. It is noted that a casing **79** of the scanning section **12** is provided on an upper side of the casing **80**.

As shown in FIG. **2**, the sheet-supply trays **21**, **22** are disposed below a recording portion **40** which will be described below. In the printing section **11**, each recording sheet **50** is selectively supplied from the sheet-supply tray **21** or the sheet-supply tray **22** into the printing section **11**. The supplied recording sheet **50** is conveyed or fed in a conveying direction through a first sheet-convey path **16** which will be described below. After an image has been recorded on the conveyed recording sheet **50** by the recording portion **40**, the recording sheet **50** is discharged onto a sheet-discharge tray **23** provided on an upper face of the sheet-supply tray **22**. Here, the conveying direction is a direction indicated by broken-line arrow and one-dot chain-line arrow shown in FIG. **2**.

As shown in FIGS. **1** and **2**, the sheet-supply trays **21**, **22** are disposed so as to have a two-tier structure in a vertical direction in which the sheet-supply tray **22** is located on an upper face of the sheet-supply tray **21**. Providing the two sheet-supply trays **21**, **22** permits the recording sheets **50** having different sizes or types to be accommodated in the two sheet-supply trays **21**, **22**.

<First Sheet-Convey Path **16**>

As shown in FIG. **2**, the first sheet-convey path **16** is defined in the printing section **11** in order to guide the recording sheet **50**. The first sheet-convey path **16** extends from a position just above an inclined plate **34** of the sheet-supply tray **21** or an inclined plate **24** of the sheet-supply tray **22** to the sheet-discharge tray **23** via the recording portion **40**. The first sheet-convey path **16** is constituted by a curved path **17** indicated by a broken line in FIG. **2** and a sheet-discharge path **18** indicated by a one-dot chain line in FIG. **2**. The curved path **17** curves and extends from the position just above the inclined plate **34** or **24** to a convey-roller pair **59** which will be described below. The sheet-discharge path **18** continues to the curved path **17** and extends in a generally straight manner from the convey-roller pair **59** to the sheet-discharge tray **23** via a position just under the recording portion **40**.

The curved path **17** is defined by an outer guide member **51** and an inner guide member **52** with a specific distance interposed therebetween. The sheet-discharge path **18** is defined by the recording portion **40**, an upper guide member **53**, and a first frame main body **54**. The upper guide member **53** is provided on a downstream side of the recording portion **40** in the conveying direction. The first frame main body **54** faces the recording portion **40** and the upper guide member **53** with a specific distance interposed therebetween. It is noted that each of the outer guide member **51**, the inner guide member **52**, the upper guide member **53**, the first frame main body **54**, and a lower guide member **55** which will be described below extends in a direction perpendicular to a sheet face of FIG. **2**, i.e., the rightward and leftward direction **9** in FIG. **1**.

<Supply Portions **28**, **38**>

When the sheet-supply tray **22** has been completely mounted in the printing section **11**, the inclined plate **24** is located under the first sheet-convey path **16**, and the sheet-supply tray **22** is located under a first supply portion **28**. The first supply portion **28** includes a sheet-supply roller **25**, a first arm such as a sheet-supply arm **26**, and a shaft **27**. The sheet-supply roller **25** is rotatably provided on a distal end portion of the sheet-supply arm **26**. This sheet-supply roller **25** is rotated by a drive power transmitted via a drive-power transmitting mechanism **29** from an ASF (Auto Sheet Feed) motor, not shown, as a drive source different from a sheet-convey motor **102** (see FIGS. **3** and **5**). The drive-power transmitting mechanism **29** is supported by the sheet-supply arm **26** and constituted by a plurality of gears arranged in a generally straight manner. Opposite end portions of the shaft **27** are rotatably supported by a second right plate **83** and a second left plate **84** which will be explained below.

The sheet-supply arm **26** is supported at a basal end portion thereof by the shaft **27** so as to be pivotable about the shaft **27**. The sheet-supply arm **26** is thus movable upward and downward so as to be moved toward and away from the sheet-supply tray **22**. Further, the sheet-supply arm **26** is urged by its own weight or an elastic force of an elastic member such as a spring so as to be pivoted in a direction indicated by an arrow **30** in FIG. **2**. This allows the sheet-supply roller **25** to be brought into pressing contact with an upper face of an uppermost one of the recording sheets **50** accommodated in the sheet-supply tray **22**. That is, the sheet-supply arm **26** can be pivoted to take a first posture in which the sheet-supply roller **25** can be brought into contact with a sheet-placed face of the sheet-supply tray **22** on which the recording sheets **50** are placed or stacked, that is, a distal end portion of the sheet-supply arm **26** contacts the sheet-placed face.

Further, when the sheet-supply tray **22** is inserted into the printing section **11** or when the sheet-supply tray **22** is pulled to be removed from the printing section **11**, the sheet-supply arm **26** is pressed by the upper face of the sheet-supply tray **22** (e.g., the inclined plate **24**) so as to be pivoted upward. As a result, the sheet-supply arm **26** can be pivoted to take a second posture in which the distal end portion of the sheet-supply arm **26** is distant from the sheet-placed face.

The sheet-supply arm **26** is urged by its own weight or the elastic force of, e.g., the spring so as to be pivoted toward the sheet-supply tray **22**. The first supply portion **28** picks up the recording sheet **50** from the sheet-supply tray **22** to supply the sheet **50** to the curved path **17**. A second supply portion **38** has the same construction as the first supply portion **28**. That is, the second supply portion **38** includes a sheet-supply roller **35**, a sheet-supply arm **36**, a shaft **37**, and a drive-power transmitting mechanism **39** and picks up the recording sheet **50** from the sheet-supply tray **21** to supply the sheet **50** to the curved path **17**.

<Convey-Roller Pair **59**>

As shown in FIG. **2**, in the first sheet-convey path **16** is provided the convey-roller pair **59** as an example of a first roller pair which is located on an upstream side of the recording portion **40** in the conveying direction. The convey-roller pair **59** is constituted by a convey roller **60** and a pinch roller **61**. The convey roller **60** is disposed at an upper portion of the first sheet-convey path **16** and rotated by a drive power of the sheet-convey motor **102**. The pinch roller **61** is rotatably disposed so as to face the convey roller **60** with the first sheet-convey path **16** interposed therebetween, that is, the pinch roller **61** is rotatably disposed at a lower portion of the

first sheet-convey path **16**. The pinch roller **61** is urged toward the convey roller **60** by a spring, for example. As a result, the convey-roller pair **59** nips and conveys the sheet **50** toward the recording portion **40** through the first sheet-convey path **16**, i.e., in the conveying direction.

<Discharge-Roller Pair **64**>

As shown in FIG. **2**, in the first sheet-convey path **16** (the sheet-discharge path **18**) is provided a discharge-roller pair **64** as an example of a second roller pair which is located on a downstream side of the recording portion **40** in the conveying direction. The discharge-roller pair **64** is constituted by a sheet-discharge roller **62** and a spur roller **63**. The sheet-discharge roller **62** is disposed at the lower portion of the sheet-discharge path **18** and rotated by the drive power of the sheet-convey motor **102**. The spur roller **63** is rotatably disposed on an upper side of the sheet-discharge roller **62** with the sheet-discharge path **18** interposed therebetween. The spur roller **63** is urged toward the sheet-discharge roller **62** by a spring, for example. As a result, the discharge-roller pair **64** nips and conveys the sheet **50** toward the sheet-discharge tray **23** through the sheet-discharge path **18**, i.e., toward a downstream side in the conveying direction.

<Midway-Roller Pair **56**>

As shown in FIG. **2**, in the first sheet-convey path **16** (the curved path **17**) is provided a midway-roller pair **56** which is located on an upstream side of the convey-roller pair **59** in the conveying direction. The midway-roller pair **56** is constituted by a first midway roller **57** and a second midway roller **58**. The first midway roller **57** is disposed at an outer portion of the curved path **17** and rotated by a drive power of the sheet-convey motor **102**. The second midway roller **58** is rotatably disposed so as to face the first midway roller **57** with the curved path **17** interposed therebetween. The second midway roller **58** is urged toward the first midway roller **57** by a spring, for example. As a result, the midway-roller pair **56** nips and conveys the sheet **50** toward the convey-roller pair **59** through the curved path **17**.

It is noted that the drive power of the sheet-convey motor **102** is transmitted to rollers such as the convey roller **60** via an intermediate gear, not shown, and a belt, not shown.

<Recording Portion **40**>

As shown in FIG. **2**, the recording portion **40** includes recording heads **42** and a carriage **41** on which the recording heads **42** are mounted and which is reciprocated in a main scanning direction that coincides with the direction perpendicular to the sheet face of FIG. **2**. Inks of respective four colors, namely, cyan (C), magenta (M), yellow (Y), and black (Bk) are respectively supplied to the recording heads **42** from ink cartridges, not shown. Each recording head **42** ejects the ink as fine ink droplets from nozzles formed in a lower face thereof. The carriage **41** is reciprocated in the main scanning direction, whereby the recording heads **42** are accordingly reciprocated relative to the recording sheet **50**. The recording heads **42** eject the respective inks while being reciprocated to record an image on the recording sheet **50** being conveyed on a support member such as a platen **43** through the sheet-discharge path **18**. The platen **43** is provided under the recording portion **40** so as to face the recording portion **40** in order to support the recording sheet **50** being conveyed at the position just under the recording portion **40** along the sheet-discharge path **18**. The platen **43** is supported by the first frame main body **54**.

After the recording sheet **50** is supplied to the curved path **17** from the sheet-supply tray **22** by the first supply portion **28** or from the sheet-supply tray **21** by the second supply portion **38**, the sheet **50** is guided by the convey-roller pair **59** to the recording portion **40** at which the image is recorded by the recording heads **42**. The sheet **50** is then discharged onto the sheet-discharge tray **23** by the discharge-roller pair **64**.

<Path Switch Portion **97** and Reverse-Roller Pair **65**>

As shown in FIG. **2**, a path switch portion **97** and a reverse-roller pair **65** as an example of a third roller pair are provided for guiding, to a second sheet-convey path **90** which will be described below, the recording sheet **50** located downstream of the discharge-roller pair **64** in the conveying direction in the sheet-discharge path **18**. The path switch portion **97** is provided on a downstream side of the discharge-roller pair **64** in the conveying direction. The reverse-roller pair **65** is provided on a downstream side of the path switch portion **97** in the conveying direction.

The reverse-roller pair **65** is constituted by a drive roller **66** and spur rollers **67**. The drive roller **66** is disposed at the lower portion of the first sheet-convey path **16** (the sheet-discharge path **18**) and rotated by the drive power of the sheet-convey motor **102**. The spur rollers **67** are rotatably disposed on an upper side of the drive roller **66** with the first sheet-convey path **16** interposed therebetween. The spur rollers **67** are urged toward the drive roller **66** by a spring, for example. This allows the reverse-roller pair **65** to nip the recording sheet **50**. The drive roller **66** is rotatable forwardly and reversely. When rotated forwardly, the drive roller **66** conveys the recording sheet **50** in the conveying direction. When rotated reversely, the drive roller **66** conveys the recording sheet **50** in a direction opposite to the conveying direction.

The path switch portion **97** includes a flap **96**, a shaft **98**, and sub-rollers **100**, **101**. The flap **96** is pivotable about the shaft **98** between (a) a sheet-discharge posture as an example of a third posture indicated by a solid line in FIG. **2** and (b) a sheet-reverse posture as an example of a fourth posture indicated by a broken line in FIG. **2**. The sheet-discharge posture is a posture for conveying the recording sheet **50** having passed through the recording portion **40** to the downstream side through the first sheet-convey path **16** and discharging the sheet **50** onto the sheet-discharge tray **23**. The sheet-reverse posture is a posture for guiding the recording sheet **50** to the second sheet-convey path **90**. The sub-rollers **100**, **101** each as a spur roller are rotatably mounted on a lower face of the flap **96**. Opposite end portions of the shaft **98** are rotatably supported by the second right plate **83** and the second left plate **84** which will be explained below.

The path switch portion **97** is normally kept in the sheet-reverse posture by being pivoted downward by its own weight. When a leading end of the recording sheet **50** having passed through the position just under the recording portion **40** has reached the path switch portion **97** in the state which the path switch portion **97** is in the sheet-reverse posture, the path switch portion **97** is pressed by the upper face of the recording sheet **50**, which changes the posture of the path switch portion **97** from the sheet-reverse posture to the sheet-discharge posture. In this state, the recording sheet **50** continued to be conveyed is nipped by the reverse-roller pair **65** provided downstream of the path switch portion **97** in the conveying direction. Since the drive roller **66** is being forwardly rotated in the state in which the path switch portion **97** is kept in the sheet-discharge posture, the recording sheet **50** is conveyed toward the sheet-discharge tray **23**. When a trailing end portion of the recording sheet **50** has reached a predetermined position located on an upstream side of the sub-roller **101**, a force of the path switch portion **97** for pivoting the path switch portion **97** toward a sheet-reverse posture side by its own weight becomes larger than a force of the recording sheet **50** for pressing the path switch portion **97** upward. Accordingly, the posture of the path switch portion **97** is changed from the sheet-discharge posture to the sheet-reverse

posture. As a result, the trailing end portion of the recording sheet **50** is pressed by the sub-roller **101** downward so as to be directed toward the second sheet-convey path **90** or a sheet-reverse path **90**.

In a case of one-side recording, the drive roller **66** continues to be rotated forwardly. As a result, the recording sheet **50** is discharged onto the sheet-discharge tray **23**. On the other hand, in a case of two-side recording, the rotation of the drive roller **66** is changed from the forward rotation to the reverse rotation in the state in which the trailing end portion of the recording sheet **50** is directed to the second sheet-convey path **90**. As a result, the recording sheet **50** is switched back or conveyed into the second sheet-convey path **90**.

<Second Sheet-Convey Path **90**>

As shown in FIG. **2**, the second sheet-convey path **90** is provided in the printing section **11**. The second sheet-convey path **90** guides the recording sheet **50** from a downstream side of the recording portion **40** in the conveying direction in the first sheet-convey path **16**, to an upstream side of the convey-roller pair **59** in the conveying direction in the first sheet-convey path **16**. The second sheet-convey path **90** is branched at a branch opening **91** from the first sheet-convey path **16** (the sheet-discharge path **18**) and extends so as to pass through a position below the recording portion **40** and above the sheet-supply tray **22** and then merges with the first sheet-convey path **16** (the curved path **17**) at a meeting point **92**. The recording sheet **50** is conveyed through the second sheet-convey path **90** in a sheet-resupply direction indicated by a two-dot chain-line arrow in FIG. **2**. The recording sheet **50** on which the image is recorded on a front face thereof by the recording portion **40** is flipped or turned upside down by passing through the second sheet-convey path **90** and supplied to the recording portion **40** again. Then, an image is recorded on a back face of the recording sheet **50** by the recording portion **40** in the same manner as the image is recorded on the front face.

The second sheet-convey path **90** is defined by the above-described first frame main body **54** and the lower guide member **55** provided under the first frame main body **54** so as to face the first frame main body **54** with a specific distance interposed therebetween.

<Reconvey-Roller Pair **68** and Sheet-Convey Arm **74**>

In the second sheet-convey path **90** is provided a reconvey-roller pair **68** which is constituted by a reconvey or resupply roller **69** and a pinch roller **70** as an example of a nip member. The pinch roller **70** is disposed at an upper portion of the second sheet-convey path **90** so as to be pressed by the reconvey roller **69** as will be described below. The reconvey roller **69** is disposed at the lower portion of the second sheet-convey path **90** so as to face the pinch roller **70** with the second sheet-convey path **90** interposed therebetween. The reconvey roller **69** is rotated by the drive power of the sheet-convey motor **102**. The rotation of the reconvey roller **69** causes the reconvey-roller pair **68** to nip and convey the recording sheet **50** conveyed from the branch opening **91** to the second sheet-convey path **90**, to the meeting point **92**, i.e., to the first sheet-convey path **16**.

A second arm such as sheet-convey arm **74** is provided under the lower guide member **55**. The sheet-convey arm **74** is supported at its basal end portion (i.e., its front end portion) by the shaft **27** so as to be pivotable about the shaft **27**. The reconvey roller **69** is rotatably supported by a shaft at a distal end portion (i.e., a rear end portion) of the sheet-convey arm **74**. A coil spring, not shown, is mounted on the sheet-convey arm **74**. The sheet-convey arm **74** is urged by an elastic force of the coil spring so as to be pivoted in a direction indicated by an arrow **71**. As a result, the reconvey roller **69** is held in pressing contact with the pinch roller **70**. In the present embodiment, the sheet-convey arm **74** and the sheet-supply arm **26** are pivotable about the same pivotal shaft, i.e., the shaft **27**. It is noted that the sheet-convey arm **74** and the sheet-supply arm **26** may be pivoted by different pivotal shafts.

<First Frame **76**>

As shown in FIGS. **3** and **4**, the printing section **11** includes three metal frames, namely, a first frame **76**, a the second frame **77**, and a third frame **78**. Each of the frames **76**, **77**, **78** is mounted on an upper portion of the casing **80** of the printing section **11**. That is, each frame **76**, **77**, **78** is supported by the casing **80**.

As shown in FIG. **5**, the first frame **76** is constituted by the first frame main body **54** as an example of a bottom plate, a pair of side plates (i.e., a first right plate **81** and a first left plate **82**), and guide rails **45**, **46**.

The first frame main body **54** is formed by a generally flat rectangular plate expanding in the frontward and rearward direction **8** and the rightward and leftward direction **9**. The platen **43** is supported by an upper face of the first frame main body **54**. The first right plate **81** is provided upright on a right end of the upper face of the first frame main body **54** in the rightward and leftward direction **9**. The first left plate **82** is provided upright on a left end of the upper face of the first frame main body **54** in the rightward and leftward direction **9**. It is noted that opposite end portions of the first frame main body **54** in the frontward and rearward direction **8** are bent in order for the first frame main body **54** not to be easily warped.

Each of the first right plate **81** and the first left plate **82** is formed by a generally flat rectangular plate expanding in the upward and downward direction **7** and the frontward and rearward direction **8**. That is, each of the first right plate **81** and the first left plate **82** is provided upright so as to expand in the frontward and rearward direction **8** (i.e., in the conveying direction). Further, a distance in the rightward and leftward direction **9** between the first right plate **81** and a center of the recording sheet **50** conveyed through the sheet-discharge path **18** in a widthwise direction of the recording sheet **50** (i.e., in the rightward and leftward direction **9**) is the same as a distance in the rightward and leftward direction **9** between the first left plate **82** and the center of the recording sheet **50**. That is, the first right plate **81** and the first left plate **82** are mounted on the first frame main body **54** so as to be symmetric in the rightward and leftward direction **9** with respect to the center of the recording sheet **50**.

The guide rails **45**, **46** are mounted on respective upper faces of the first right plate **81** and the first left plate **82**. Each of the guide rails **45**, **46** has a flat plate shape extending in a widthwise direction of the sheet-discharge path **18**, i.e., in the rightward and leftward direction **9**. The guide rails **45**, **46** are disposed so as to be distant from each other in the conveying direction at a specific distance therebetween. As described above, the recording heads **42** are held on the carriage **41**. Further, the carriage **41** is supported on the guide rails **45**, **46** so as to be slidable in the widthwise direction of the sheet-discharge path **18**, i.e., in the rightward and leftward direction **9**. That is, the first frame **76** supports the recording portion **40**.

Opposite end portions of each of the convey-roller pair **59**, the discharge-roller pair **64**, and the pinch roller **70** in their respective axial directions (i.e., in the rightward and leftward direction **9**) are rotatably supported by the first right plate **81** and the first left plate **82**.

<Second Frame **77**>

As shown in FIG. **6**, the second frame **77** is constituted by an upper plate **86**, the lower guide member **55**, and the pair of side plates (the second right plate **83** and the second left plate **84**).

The upper plate **86** is formed by a generally rectangular flat plate expanding in the frontward and rearward direction **8** and the rightward and leftward direction **9**. The upper guide member **53** is mounted on a lower face of the upper plate **86**. The lower face of the upper plate **86** is fixed at its right end to a front end of an upper face of the second right plate **83**. Further, the lower face of the upper plate **86** is fixed at its left end to an upper face of the second left plate **84**.

Each of the second right plate **83** and the second left plate **84** is formed by a generally rectangular flat plate expanding in the upward and downward direction **7** and the frontward and rearward direction **8**. The second right plate **83** is longer than the second left plate **84** in the frontward and rearward direction **8**. Opposite end portions of each of the shaft **27** of the sheet-supply arm **26**, the sheet-convey arm **74**, the reverse-roller pair **65**, and the shaft **98** of the path switch portion **97** in their respective axial directions (i.e., in the rightward and leftward direction **9**) are rotatably supported by the second right plate **83** and the second left plate **84**. It is noted that the sheet-supply arm **36** may or may not be supported by the second right plate **83** and the second left plate **84**, i.e., the second frame **77**. However, even where the sheet-supply arm **36** is not supported by the second frame **77**, the sheet-supply arm **36** is not supported by the first frame **76** and is supported by a frame other than the first frame **76** or the second frame **77**.

The lower guide member **55** is formed by a generally rectangular flat plate expanding in the frontward and rearward direction **8** and the rightward and leftward direction **9**. Below the upper guide member **53**, a front end portion of the lower guide member **55** is mounted at its right end on a left side face of the second right plate **83** and mounted at its left end on a right side face of the second left plate **84**. An upper face of the lower guide member **55** (i.e., a sheet-convey face for conveying the recording sheet **50** through the second sheet-convey path **90**) is inclined downward from the front end portion thereof toward a rear side thereof.

As shown in FIG. **5**, a recessed portion **87** is formed in a front end portion of the first right plate **81** of the first frame **76**, and a recessed portion **88** is formed in a front end portion of the first left plate **82** of the first frame **76**. The recessed portions **87**, **88** are recessed rearward, that is, opened frontward. Projecting portions **120**, **121** of the second frame **77** which will be described below are respectively inserted into the recessed portion **87**, **88**. A width of each recessed portion **87**, **88** in the upward and downward direction **7** is larger than that of each projecting portion **120**, **121** in the upward and downward direction **7**. Further, as shown in FIG. **6**, the projecting portion **120** is provided on the left side face of the second right plate **83** so as to project leftward. Specifically, the projecting portion **120** is located at a generally central position of the left side face in the frontward and rearward direction **8** and near an upper end thereof in the upward and downward direction **7**. The projecting portion **121** is provided on the right side face of the second left plate **84** so as to project rightward from a position corresponding to the projecting portion **120**. Each of the projecting portions **120**, **121** is formed by a plate expanding in the frontward and rearward direction **8** and the rightward and leftward direction **9** and having a relatively small thickness in the upward and downward direction **7**. It is noted that, instead of the above-described construction, this MFD **10** may be configured such that the projecting portions are formed on the first frame **76**, and the recessed portions are formed in the second frame **77**.

When the second frame **77** is supported at its lower portion by the casing **80**, the projecting portion **120** is fitted into the recessed portion **87** of the first frame **76** such that a rear end of the projecting portion **120** is brought into rearward pressing contact with the recessed portion **87**, and the projecting portion **121** is fitted into the recessed portion **88** of the first frame **76** such that a rear end of the projecting portion **121** is brought into rearward pressing contact with the recessed portion **88**. That is, the first frame **76** is not directly connected to the second frame **77** (in other words, the first frame **76** is provided separately from the second frame **77**) but is held in contact with the second frame **77** at a downstream portion of the first frame **76** in the conveying direction.

Since the second frame **77** is pressed rearward onto the first frame **76**, the second frame **77** is positioned relative to the first frame **76** in the frontward and rearward direction **8**. However, the width of each projecting portion **120**, **121** in the upward and downward direction **7** is smaller than the width of each recessed portion **87**, **88** in the upward and downward direction **7**. Accordingly, each of the projecting portions **120**, **121** is movable in the upward and downward direction **7** in a state in which each projecting portion **120**, **121** is held in contact with a corresponding one of the recessed portions **87**, **88**. That is, the second frame **77** is not positioned relative to the first frame **76** in the upward and downward direction **7**.

<Third Frame **78**>

As shown in FIG. **5**, the third frame **78** is provided on a left side of the first left plate **82** of the first frame **76**. The third frame **78** is constituted by (a) a bottom plate, not shown, located under the sheet-convey motor **102**, (b) a third right plate **93** located on a right side of the motor **102**, and (c) a third left plate **94** located on a left side of the motor **102** such that right, left, and lower faces of the sheet-convey motor **102** are enclosed. Opposite end portions of a shaft, not shown, of the sheet-convey motor **102** in its axial direction (i.e., the rightward and leftward direction **9**) are rotatably supported respectively by the third right plate **93** and the third left plate **94**. Further, respective upper end portions of the third right plate **93** and the third left plate **94** support the convey roller **60** such that the roller **60** is rotatable.

Further, the third frame **78** is connected or tightened to the first frame **76** along a tangential direction **104** of a concentric circle (indicated by a broken line in FIG. **5**) centered about a rotational shaft of the convey roller **60**. For example, a screw **103** used to tighten or connect the third frame **78** to the guide rail **46** of the first frame **76** is tightened to the guide rail **46** in the tangential direction **104** of the concentric circle centered about the rotational shaft of the convey roller **60**.

It is noted that the third frame **78** may be provided on a right side of the first right plate **81** of the first frame **76**. Further, the third frame **78** may be provided on each of outsides of the first left plate **82** and the first right plate **81**.

<Support for First Frame **76** by Casing **80**>

FIG. **7** shows the casing **80** by removing the first frame **76** and the second frame **77** from the components shown in FIG. **3**. The casing **80** includes support members **130**, support members **131**, and support members **132**. Each of the support members **130** and the support members **131** is an example of an auxiliary support member. Each of the support members **130** has an upper face functioning as a support face **105** for supporting the first frame **76**. Each of the support members **131** has an upper face in which is formed a screw hole **106** for fixing the first frame **76**. Each of the support members **132** has an upper face in which is formed a screw hole **107** for fixing the second frame **77**. Further, the casing **80** has screw holes

108 formed therein for supporting and fixing the casing 79 of the scanning section 12, for example.

As shown in FIG. 8, the casing 80 has support faces 105A, 105B, 105C, 105D. The support face 105A is for supporting a front end portion of a lower face of the first right plate 81 of the first frame 76. The support face 105B is for supporting a rear end of the lower face of the first right plate 81. The support face 105C is for supporting a front end of a lower face of the first left plate 82 of the first frame 76. The support face 105D is for supporting a rear end of the lower face of the first left plate 82. In addition, the casing 80 has screw holes 106A, 106B formed therein. The screw hole 106A is located between the support face 105A and the support face 105B, for fixing a central portion of the lower face of the first right plate 81 of the first frame 76. The screw hole 106B is located between the support face 105C and the support face 105D, for fixing a central portion of the lower face of the first left plate 82 of the first frame 76.

The support face 105A includes a wall portion 109 provided upright so as to extend upward from front and right ends of the support face 105A. The support face 105B includes a wall portion 109 provided upright so as to extend upward from rear and right ends of the support face 105B. The support face 105C includes a wall portion 109 provided upright so as to extend upward from front and left ends of the support face 105C. The support face 105D includes a wall portion 109 provided upright so as to extend upward from rear and left ends of the support face 105D.

As shown in FIGS. 9A and 9B, a position of each of the support faces 105A, 105B in the upward and downward direction 7 is slightly higher than a position of each of the support faces 105C, 105D in the upward and downward direction 7. Further, a position of the screw hole 106A in the upward and downward direction 7 is slightly lower than a position of the screw hole 106B in the upward and downward direction 7. The support faces 105A, 105B and the screw hole 106B are located at the same height, and the support faces 105C, 105D and the screw hole 106A are located at the same height.

Where the first frame 76 has been placed from an upper side of the support faces 105 and the screw holes 106, the first frame 76 is brought into contact with the support faces 105A, 105B and the screw hole 106B. That is, the first frame 76 is supported at its lower portion by the casing 80 at three points. In other words, the first frame 76 is supported by the three portions of the casing 80.

On the other hand, the support faces 105C, 105D and the screw hole 106A are located near a lower portion of the first frame 76 and not brought into contact with the first frame 76. However, where the first frame 76 has been displaced downward from its original position due to a warp, a twist, or the like thereof, the support faces 105C, 105D and the screw hole 106A can support the first frame 76. That is, each of the support faces 105C, 105D and the screw hole 106A is an example of the auxiliary support member.

The first frame 76 and the casing 80 are fixed to each other by a screw 110. Specifically, as shown in FIG. 9B, the screw 110 is inserted through the first left plate 82 from an upper side thereof and tightened to the screw hole 106B of the support member 131 being held in contact with the first left plate 82. As a result, the first left plate 82 and the casing 80 are fixed to each other by the screw 110. However, the screw hole 106A has a diameter larger than that of the screw 110. Accordingly, the screw 110 penetrates or passes through the first right plate 81 from an upper side thereof but is not tightened to the screw hole 106A though the screw 100 is inserted through the screw hole 106A. That is, the first right plate 81 is not fixed to the casing 80 by the screw 110.

In view of the above, the first frame 76 is fixed to the casing 80 at one point (the screw hole 106B) of the three points (the support faces 105C, 105D and the screw hole 106B) supported by the casing 80.

It is noted that a height relationship between the support faces 105 and the screw holes 106 is not limited to the above-described relationship. For example, this MFD 10 may be configured such that the positions of the support faces 105A, 105E in the upward and downward direction 7 are slightly lower than the positions of the support faces 105C, 105D in the upward and downward direction 7, and the position of the screw hole 106A in the upward and downward direction 7 is slightly higher than the position of the screw hole 106B in the upward and downward direction 7.

ADVANTAGES OF EMBODIMENT

In the above-described embodiment, the first frame 76 supports the recording portion 40. On the other hand, the second frame 77 supports the sheet-supply arm 26 on which is mounted the sheet-supply roller 25 for supplying the recording sheet 50 to the first sheet-convey path 16. Further, the first frame 76 and the second frame 77 are not directly connected to each other. As a result, a force of the sheet-supply arm 26 in the upward and downward direction 7, which force is generated by the sheet-supply operation of the sheet-supply arm 26 for supplying the recording sheet 50 acts only on the second frame 77 and does not act on the first frame 76. Accordingly, even where the sheet-supply operation for supplying a certain recording sheet 50 has been performed during the image recording on another recording sheet 50, it is possible to reduce an effect of the sheet-supply operation on the image recording, thereby reducing a deterioration of a quality of the image recorded on the recording sheet 50.

Further, in the above-described embodiment, the first frame 76 is supported by the casing 80 at the three points. In the case of the three-point support, even where a height or heights of at least one of the three points have been changed, a plane including the three points is determined as a flat plane, which never causes a twist or a distortion. Accordingly, even where the casing 80 has been bent or distorted because the casing 80 is placed at an uneven position, and an effect of the bend or distortion has affected the first frame 76, it is possible to prevent the distortion of the first frame 76. It is noted that, as described above, the first frame 76 and the second frame 77 are separate from each other or are not connected to each other, but both of the first frame 76 and the second frame 77 are supported by the casing 80. Thus, the force of the sheet-supply arm 26 in the upward and downward direction 7 may act on the second frame 77 and then disadvantageously act on the first frame 76 via the casing 80. However, in the present embodiment, the first frame 76 is supported by the casing 80 at the three points, thereby making it possible to prevent the first frame 76 from bending by the force exerted from the second frame 77.

Where the first frame 76 is fixed to the casing 80 at the three points and where the height or heights of at least one of the three points have been changed, the first frame 76 may be distorted. However, this MFD 10 is configured such that the first frame 76 is fixed to the casing 80 at the one point and the other two points are merely supported without being fixed. Accordingly, even where the height or heights of at least one of the three points have been changed, it is possible to prevent the distortion of the first frame 76.

The three-point support of the casing 80 for the first frame 76 has less stability than a four-point support, for example. Thus, where the printing section 11 has been swayed vio-

lently, for example, the first frame **76** may be inclined greatly. However, in the above-described embodiment, the support members **130**, **131** provided near the lower portion of the first frame **76** support the first frame **76** which is to be inclined, thereby preventing the first frame **76** from being inclined greatly.

Further, in the above-described embodiment, the first frame **76** is held in contact at its front portion with the second frame **77**. As a result, the second frame **77** is positioned relative to the first frame **76** in the frontward and rearward direction **8** (along the conveying direction). Further, the second frame **77** is not positioned relative to the first frame **76** in the upward and downward direction **7**. Accordingly it is possible to prevent that the force of the sheet-supply arm **26** in the upward and downward direction **7** (which force is generated by the sheet-supply operation) acts on the first frame **76**.

Further, in the above-described embodiment, the path switch portion **97** is supported by the second frame **77**. As a result, it is possible to prevent a force generated by the posture-change of the path switch portion **97** from acting on the first frame **76**.

Further, in the above-described embodiment, the sheet-convey arm **74** is supported by the second frame **77**. As a result, it is possible to prevent that a force of the sheet-convey arm **74** generated by the operation of the reconvey roller **69** and the pinch roller **70** for nipping the recording sheet **50** conveyed through the second sheet-convey path **90** acts on the first frame **76**.

Further, in the above-described embodiment, the first right plate **81** and the first left plate **82** for supporting the convey-roller pair **59** are provided so as to be symmetric in the rightward and leftward direction **9** with respect to the center of the recording sheet **50** in its widthwise direction coinciding with the rightward and leftward direction **9**. Accordingly, it is possible to reduce variations in conveying amounts and accuracies in the widthwise direction of the recording sheet **50** when the recording sheet **50** is conveyed.

Further, in the above-described embodiment, the sheet-convey motor **102** is supported by the third frame **78** which does not support the convey-roller pair **59** and the discharge-roller pair **64**. Accordingly, it is possible to prevent that an effect of a weight of the sheet-convey motor **102** or a force generated by, e.g., vibration of the sheet-convey motor **102** during its driving affects or acts on the first frame **76**. Further, since there is no need for the first frame **76** to support the sheet-convey motor **102**, the first frame **76** can be made smaller.

Further, in the above-described embodiment, the third frame **78** is positioned vertically relative to the rotational shafts of the convey-roller pair **59**. Accordingly, when the third frame **78** is connected or tightened to the first frame **76**, it is possible to prevent a force in the rightward and leftward direction **9** from being transmitted from the third frame **78** to the first frame **76**.

What is claimed is:

1. An image recording apparatus comprising:

a casing in which a first conveying path for guiding a recording medium in a conveying direction is provided;

a recording portion configured to record an image on the recording medium guided by the first conveying path;

a tray provided below the recording portion so as to accommodate the recording medium;

a supplying roller configured to supply the recording medium accommodated by the tray to the first conveying path;

a first arm provided above the tray, wherein the supplying roller is provided on a distal end of the first arm;

a first frame supported by the casing and supporting the recording portion; and

a second frame supported by the casing, provided separately from the first frame, and supporting the first arm, wherein a position of the second frame in a frontward and rearward direction is determined by a position of the first frame, and wherein a portion of the second frame, in contact with a portion of the first frame, moves in an upward and downward direction with respect to the portion of the first frame in response to a force applied through the first arm in the upward and downward direction while the supplying roller supplies the recording medium.

2. The image recording apparatus according to claim **1**, further comprising:

a first roller pair provided on an upstream side of the recording portion in the conveying direction in the first conveying path and configured to convey the recording medium; and

a second roller pair provided on a downstream side of the recording portion in the conveying direction in the first conveying path and configured to convey the recording medium.

3. The image recording apparatus according to claim **2**, further comprising:

a second conveying path for guiding the recording medium from a position located on a downstream side of the recording portion in the conveying direction in the first conveying path to a position located on an upstream side of the first roller pair in the conveying direction in the first conveying path;

a path switch portion provided on a downstream side of the recording portion in the conveying direction in the first conveying path and configured to switch a path so as to selectively convey the recording medium to one of (a) a path for conveying, in the conveying direction, the recording medium having passed through the recording portion and (b) a path for conveying the recording medium to the second conveying path; and

a third roller pair provided on a downstream side of the path switch portion in the conveying direction in the first conveying path so as to be rotatable in a forward direction and in a reverse direction, wherein the third roller pair is rotated in one of the forward and reverse directions to convey the recording medium in the conveying direction and is rotated in the other of the forward and reverse directions to convey the recording medium in a direction opposite to the conveying direction;

wherein the second frame is configured to support the path switch portion and the third roller pair.

4. The image recording apparatus according to claim **3**, further comprising:

a nip member disposed above the second conveying path;

a resupply roller provided below the nip member so as to face the nip member and nip the recording medium with the nip member to convey, to the first conveying path, the recording medium having been conveyed to the second conveying path; and

a second arm pivotably provided below the second conveying path, wherein the resupply roller is mounted on a distal end of the second arm;

wherein the first frame is configured to support the nip member; and

wherein the second frame is configured to support the second arm.

5. The image recording apparatus according to claim 2, wherein the first frame includes:

a support member configured to support the recording medium conveyed through a position just under the recording portion in the first conveying path;

a bottom plate;

a pair of side plates provided so as to extend in the conveying direction and to stand respectively from opposite ends of the bottom plate in a widthwise direction thereof which is a direction perpendicular to the conveying direction and along the support member;

wherein the first roller pair is supported by the pair of side plates; and

wherein the pair of side plates are provided so as to be symmetric in the widthwise direction with respect to a center of the recording medium supported by the support member in the widthwise direction.

6. The image recording apparatus according to claim 5, further comprising a third frame provided on at least one of opposite sides of the pair of side plates in the widthwise direction so as to support a driving portion for driving the first roller pair and the second roller pair.

7. The image recording apparatus according to claim 6, wherein the third frame is connected to the first frame along a tangential direction of a concentric circle centered about a rotational shaft of the first roller pair.

8. The image recording apparatus according to claim 1, further comprising a casing configured to support the first frame.

9. The image recording apparatus according to claim 8, wherein the first frame is supported by the casing at three points.

10. The image recording apparatus according to claim 9, wherein the first frame is fixed to the casing at one of the three points.

11. The image recording apparatus according to claim 8, wherein the casing includes at least one auxiliary support member disposed below the first frame so as to support the first frame.

12. The image recording apparatus according to claim 8, wherein the second frame is supported by the casing separately from the first frame.

13. The image recording apparatus according to claim 1, wherein the second frame is positioned relative to the first frame in the conveying direction by contacting the first frame.

14. The image recording apparatus according to claim 13, wherein one of the first frame and the second frame has a recessed portion formed therein, and the other of the first frame and the second frame has a projecting portion insertable into the recessed portion, and

wherein a width of the recessed portion in a direction perpendicular to the conveying direction is larger than that of the projecting portion in the direction perpendicular to the conveying direction.

15. An image recording apparatus comprising:

a casing;

a sheet-supply tray;

a recording portion configured to record an image on a recording sheet;

a supplying roller configured to supply the recording sheet from the sheet-supply tray to the recording portion;

a sheet-supply arm provided above the sheet-supply tray, wherein the supplying roller is provided on a distal end of the sheet-supply arm;

a first frame supported by the casing and supporting the recording portion; and

a second frame supported by the casing and supporting the sheet-supply arm, wherein a position of the second frame in a frontward and rearward direction is determined by a position of the first frame, and wherein a portion of the second frame, in contact with a portion of the first frame, moves in an upward and downward direction with respect to the portion of the first frame in response to a force applied through the first arm in the upward and downward direction while the supplying roller supplies the recording medium.

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